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On the leech fauna (Hirudinea) of the Tisza river basin in Hungary with notes on the faunal history

[Über die Egelfauna (Hirudinea) des Theiß-Einzugsgebietes in Ungarn mit Bemerkungen zur Faunengeschichte]

[A magyarországi piócafauna (Hirudinea) a Tisza vízgyüjtöjében faunatörténeti szempontok figyelembelvételével]

Hasko Nesemann and Béla Csányi

With 16 Figures and 3 Tables

Schlagwörter: Hirudinea, Tisza, Theiß, Donau, Ungarn, Fluß, Fließgewässer, Stehgewässer, Faunistik, Verbreitung, Zoogeographie

Until now, 27 species of leeches (Hirudinea) have been found in the Tisza river and its tributaries. Their distribution patterns is discussed. General zoogeographical characteristics of the Tisza- and Danube river basins are shown. The unique state of the Tisza freshwater fauna (endemisms) is presented that differs markedly from the Danubian faunal composition.

Bisher sind 27 Arten der Egel (Hirudinea) im Stromsystem der Theiß einschließlich ihrer Nebenflüsse nachgewiesen worden. Ihre Verbreitungsmuster werden diskutiert. Allgemeine zoogeographische Merkmale der Theiß und der mittleren Donau werden aufgezeigt. Die Süßwasserfauna des Theißbeckens unterscheidet sich grundlegend vom Einzugsgebiet der mittleren Donau und trägt durch ihre Endemiten einen eigenständigen, bisher kaum beachteten Charakter.

Összefoglalás: A Tisza és mellékfolyóinak vízrendszerében eddig huszonhet piócafajt (Hirudinea) lehetett kimutatni. Elterjedési körzetük kerül itt megvitatásra. A Tisza és Közép-Duna vidék zoológiai jellegzetességei kerülnek bemutatásra. A Tisza-medence édesvízi faunája alapjaiban eltér a Közép-Duna körzetétöl és egy egyedi, eddig alig vizsgált jellegzetességgel rendelkezik (mint például az endemizmus).

1 Introduction

The Tisza river has a total lenght of 960 km and belongs to the large European rivers. This is the main tributary of the Danube, its catchment area covers streams and rivers of the Central and Eastern Carpathians. The Tisza is situated between the river basin of the middle Danube and Dnjestr (Fig. 1). Compared with other large rivers, the freshwater fauna of the Tisza is rather well investigated. There is knowledge about fishes, lampreys, some groups of freshwater molluscs, crustaceans, aquatic oligochaets and even Branchiobdellids. In contrast to these taxonomical groups, the Euhirudinean leeches are only partially known (ÖRLEY 1886, SOOS 1958, 1963; KOSEL 1979, 1980, 1981, 1982a, 1982b, 1983, NESEMANN 1991a). During the last three years, thorough investigations of the fauna in the Potamon stretches of rivers has been started. As a result of this work, the authors wish to present a first overview of the class Hi-

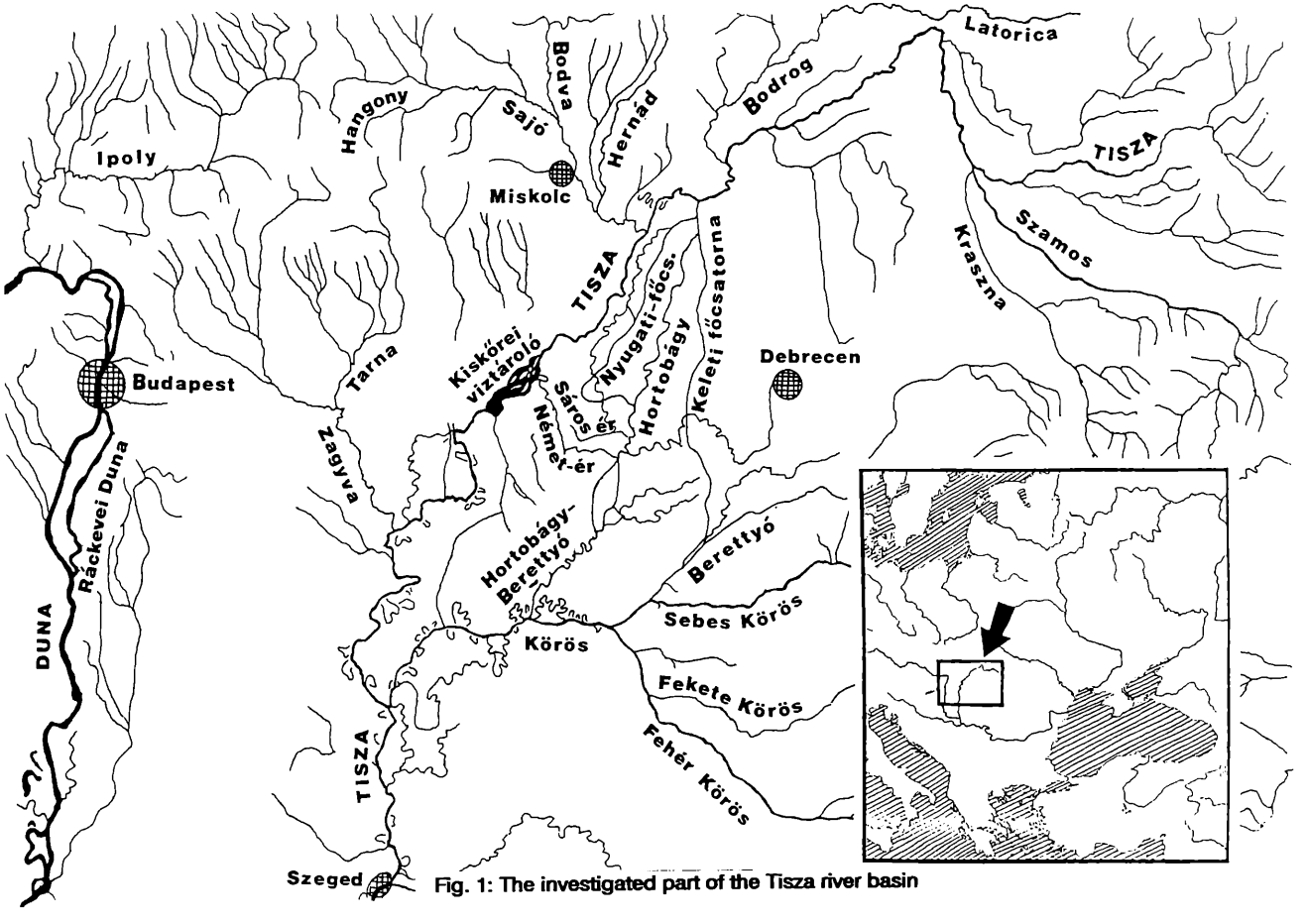


Fig. 1: The investigated part of the Tisza river basin

rudinea. Some problems of zoogeography and faunal history of the Tisza river basin are described in this paper.

2 Material and Methods

Leeches were collected by hand or using a handnet. They were killed by 15 % Ethylalcohol and preserved in 70 % Alcohol. In addition, some old material in the collection of the Hungarian Natural History Museum has been studied again and the available data in the literature are summarized. The material, collected by the authors, is offered to the leech collection of the Museum in Budapest, Zoological Department, c./o. Dr. Forró, László. For the leech determination the identification keys of SOOS (1963, 1968), SUBCHEV (1984) and SAWYER (1986) were used; the nomenclature follows SAWYER (1986).

3 Results

A total number of 27 species of leeches has been recorded, belonging to 6 families.

Subclass B r a n c h i o b d e l l i d a
Family Branchiobdellidae

Branchiobdellids are specialized on commensalisms and parasitism. They all are epibionts on crayfishes. The Branchiobdellid fauna of the tributaries of the Tisza river is relatively well known by POP (1965) and SUBCHEV (1984). By the time of our investigations, a large number of *Astacus leptodactylus* ESCHSCHOLZ 1851, collected from the Danube, Tisza, Körös, Zagyva and their large affluents, was controlled. No Branchiobdellids has been found on these specimens. Therefore the leeches seem to be absent from the lowland waters of the Hungarian Great Plain (Magyar Alföld). All available data in the literature only contain records from mountain streams and other rivers, which are situated in higher regions above sea level (e. g. Transsylvania, Bükk). One genus with four species in the Tisza basin.

***Branchiobdella parasita* (BRAUN 1805)**
Epibionts on crayfishes. This species was found in the upper Maros river basin in Roumania by POP (1965). Its host is *Astacus astacus* LINNAEUS 1758, *Astacus leptodactylus* and *Austropotamobius torrentium* SCHRANK 1804 (POP 1965, SUBCHEV 1984).

***Branchiobdella balcanica* MOSZYNSKI 1937**
Epibionts on crayfishes. A large number of specimen, collected by V. Pop from *A. astacus*, belong to this species. He added the material at first to the *Branchiobdella pentodonta*-group (POP 1965) and described a new subspecies *B. pentodonta orientalis*, which was based on his collections from the upper Szamos river basin in Roumania. Later, S. KARAMAN (1970) recognized the identity of *B. pentodonta orientalis* POP 1965, with the description of MOSZYNSKI (1937) (see identification key of SUBCHEV 1984).

***Branchiobdella hexodonta* GRUBER 1883**

Epibionts and parasites on crayfishes and inhabitants of their gills. They are known from the upper Kraszna and Maros river basins in Roumania by POP (1965). According to his information, the host is *A. astacus, A. leptodactylus* and *Austropotamobius torrentium.*

***Branchiobdella pentodonta* WHITMAN 1882**

Epibionts on crayfishes. *B. pentodonta* was recorded for the first time from Hungary by SUBCHEV (1984). It was found on *A. astacus* in the Csernely-patak, a small brook in the Bükk mountains.

Subclass E u h i r u d i n e a

Family Glossiphoniidae

Six genera with nine species in the Tisza basin.

***Glossiphonia complanata* (LINNAEUS 1758)**

Material: Upper Tisza river basin and mountainous regions, Kraszna near Mérk, 2 spec., 15 Oct. 1992, leg. B. Csányi; small brook in Mérk, a tributary ot the Kraszna river, 1 spec., 25.-28. Sept. 1990, leg. L. Forró & H. Nesemann; swampy pond in the east to Bátorliget, 6. spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann; Hernád near Hidasnémeti, 1 spec. 5. May 1992, leg. B. Csányi; Hangony near Domaháza, 2 spec. 5. May 1992, leg. B. Csányi; Latorica near Leles in Slowakia, 3 spec. 3. Jul. 1992, leg. B. Schönbauer & W. Graf; Zagyva near Jásztelek, 1spec., 5. May 1992, leg. B. Csányi; Bodva near Hidvégardó, 1 spec., 19. Aug. 1992, leg. A. Vida & H. Nesemann; Sajó near Banréve, 2 spec., 20. Aug. 1992, leg. H. Nesemann.

Middle Tisza river and Tiszántúl, Tisza near Sarud, 1 spec., 18. Nov. 1992, leg. H. Nesemann, swampy pond near the Tisza river at Tiszafüred, 1 spec., 7. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; Tisza near Poroszló, 6 spec., 18. Nov. 1992, leg. L. Forró & H. Nesemann; Tisza near Tiszafüred, 4 spec., 10. Aug. 1990, leg. M. Hauser; Feketerét near Kócsújfalu, 1 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann; Papéri-csatorna NW Balmazújváros, 3 spec., 4.-10. Jul. 1992, leg. B. Csányi & H. Nesemann; Dinnyés-csatorna W Balmazújváros, 2 spec., 10. Jul. 1992, leg. B. Csányi & H. Nesemann; Sáros-ér near Nagyiván, 3 spec., 6. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann, 1 spec., 23. Jul. 1991, leg. B. Csányi & H. Nesemann; Hortobágy near Hortobágy, 1 spec., 25. Sept. 1990, leg. L. Forró & H. Nesemann; Hortobágy NW Balmazújváros, Kis-szeg, 1 spec., 5. Jul. 1992, leg. B. Csányi & H. Nesemann; Hortobágy W Balmazújváros, bridge, 1 spec. 9. Jul. 1992, leg. B. Csányi & H. Nesemann; Hortobágy, from a secondary branch (channel) near Karcag, 3 spec., 17. Oct. 1991, leg. L. Forró & H. Nesemann; Berettyó near Darvas, 1 spec., 21. Mar. 1991, leg. L. Forró & H. Nesemann, Hortobágy-Berettyó near Ecsegfalva, 6 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann; Hortobágy-Berettyó near Túrkeve, 3 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann; Körös, from a deadwater near Szarvas, 1 spec., 23. Mar. 1992, leg. L. Forró & H. Nesemann, deadwater reach Öcsöd, 2 spec., 22. Jun. 1992, leg. L. Forró & H. Nesemann; deadwater near Békésszentandrás, 3 spec., 16. Oct. 1991, leg. L. Forró & H. Nesemann; Sebes Körös near Körösladány, 6 spec., 21. Mar. 1991, leg. L. Forró & H. Nesemann, 6 spec., 14. Jul. 1992, leg. B. Csányi.

G. complanata is widespread and abundant in various types of running and stagnant waters. This species occurs in the Potamon of lowlands as well as in the Rhithron of the mountains. In Eastern Hungary, *G. complanata* is distributed throughout the whole Tisza river basin. It is known from the bottom of the Körös river (BOTOS, SZITO & OLAH 1990) and Bátorliget (NESEMANN 1991a).

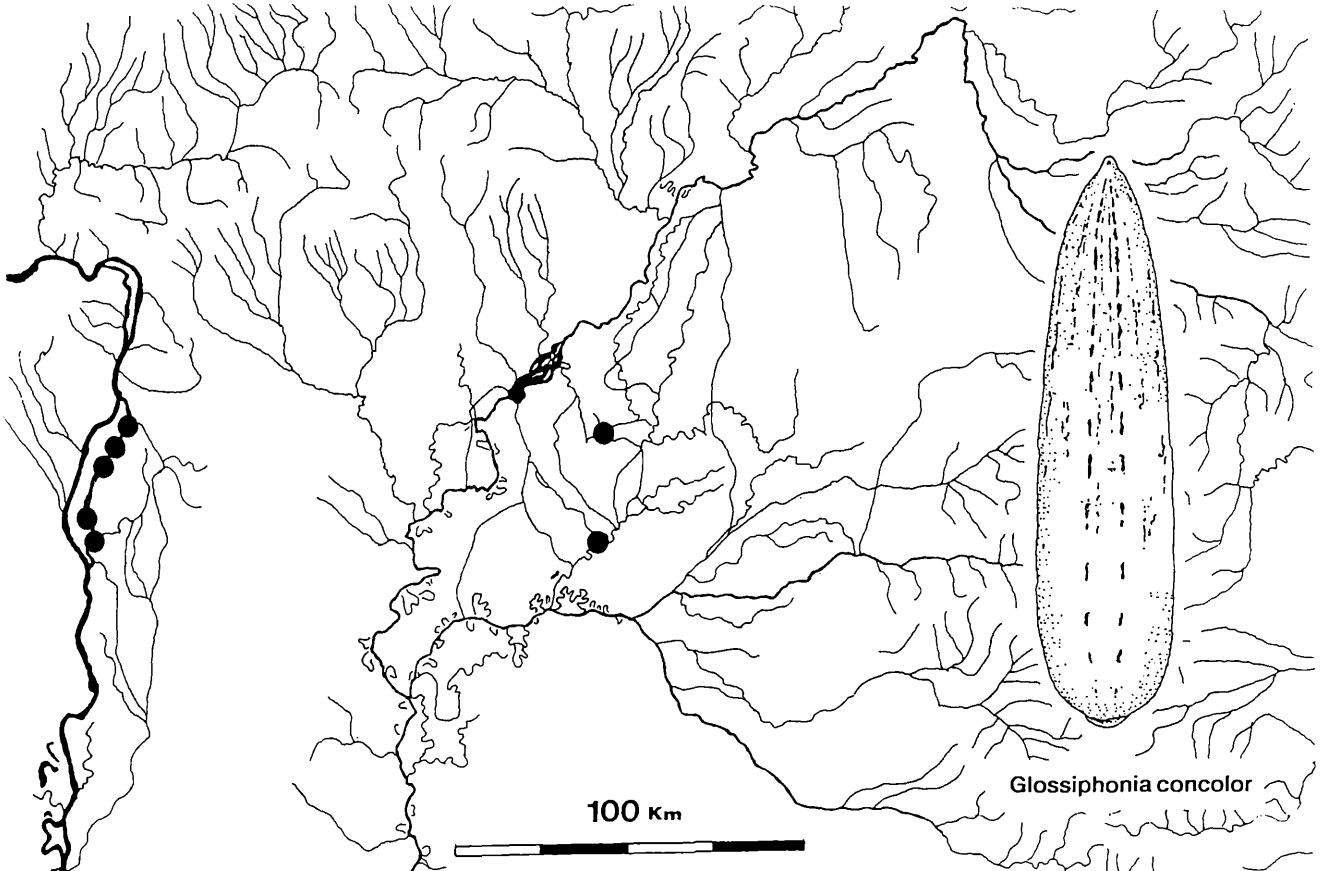


Fig. 2: Distribution of *Glossiphonia concolor* in the Alföld

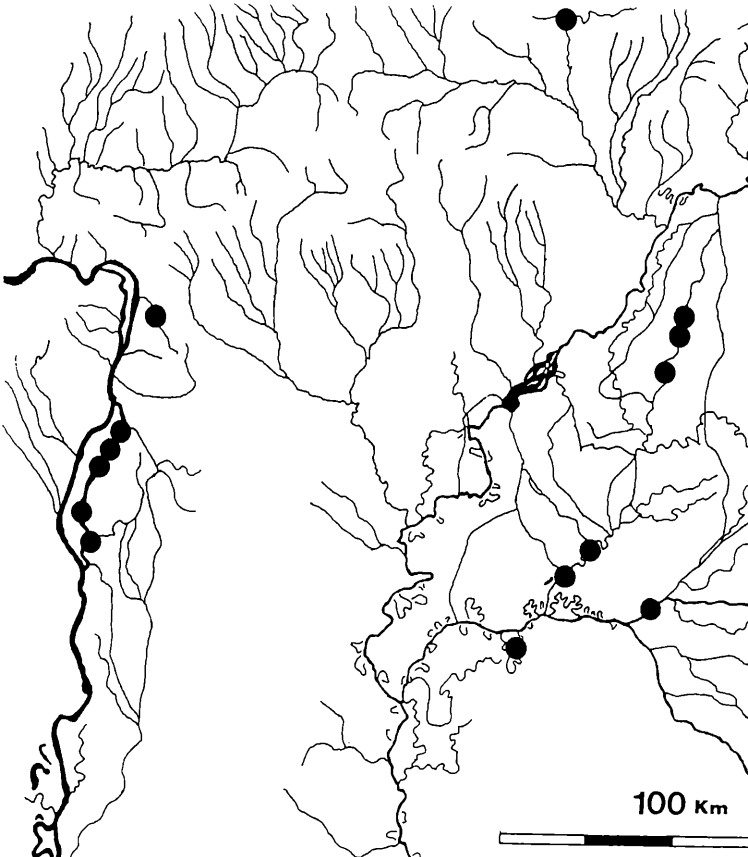
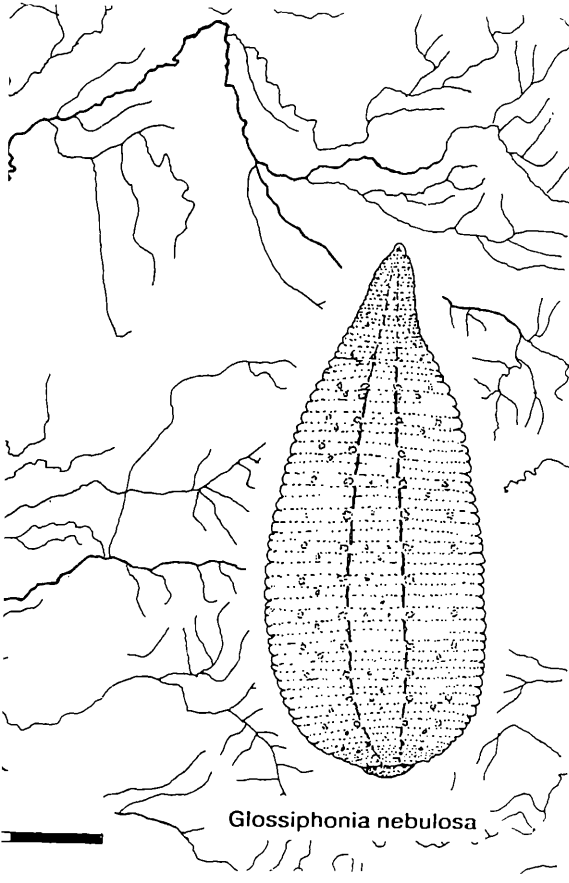


Fig. 3: Distribution of *Glossiphonia nebulosa* in the Alföld



***Glossiphonia concolor* (APATHY 1888)**

Material: Middle Tisza river, Csíkos-Fenék, Kunmadarasi puszta, 1 spec., 21. Jul. 1991, leg. B. Csányi & H. Nesemann; Hortobágy-Berettyó near Ecsegfalva, 2 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann.

New to the Tisza river basin, species of zoogeograhical importance. *G. concolor*, described from tbe Ráckevei Duna, is a typical member of the Potamon biocoenosis. Its distribution pattern includes the whole Carpathian basin (Fig. 2). *G. concolor* is common in slowly running secondary branches of lowland rivers, in wetlands and in lowland streams (KOSEL 1981, NESEMANN 1990).

***Glossiphonia nebulosa* KALBE 1964**

Material: Mountainous region, Bodva near Hidvégardó, 9 spec., 19. Aug. 1992, leg. A. Vida & H. Nesemann.

Middle Tisza river basin, Hortobágy river near Hortobágy, 2 spec. 25. Sept. 1990, leg. L. Forró & H. Nesemann; NW Balmazújváros, Kis-szeg, 3 spec., 5. Jul. 1992, leg. B. Csányi & H. Nesemann; bridge W Balmazújváros, 1 spec., 9. Jul. 1992, leg. H. Nesemann; Hortobágy-Berettyó near Ecsegfalva, 18 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann; Hortobágy-Berettyó near Túrkeve, 3 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann; Körös, secondary branch near Szarvas, 2 L. Forró & H. Nesemann.

New to the Tisza river basin, species of zoogeographical importance. Until now, *G. nebulosa* was often confused with *G. verrucata*, because of the similar dorsal arrangement of papillae. Since the finding of relict populations of *G. verrucata* along the upper Danube in Germany near Ingolstadt (NESEMANN 1993) and Passau (WEINZIERL 1989), the taxonomical status of the two species is already understandable.

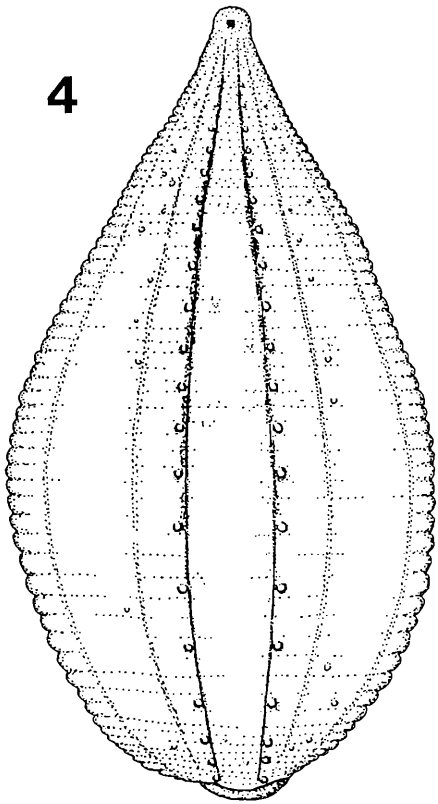
G. verrucata, a mainly Northern European species (Fig. 5), occurs only with relict populations in Central Europe, e. g. in the northern lakes of Poland and Germany, which were formed by the Pleistocene glaciation. The occurence along the Bavarian Danube is the southernmost distribution of this species. *G. verrucata* was able to enter the Danube during the Würm glacial, when there was a general spreading into southern direction. Now the populations near Ingolstadt and Passau are to regard for a Pleistocene glacial relicts.

G. nebulosa (Fig. 4), a mainly Central European species, is very common in rivers and streams of the Rhine, Danube and Rhone basins. It is restricted on running waters and frequently known from fast flowing brooks in Germany and Austria. *G. nebulosa* is widely distributed in the running waters of the Kisalföld (e. g. Lajta, NESEMANN 1992) and Alföld plains, but does not inhabit the very large lowland rivers. Therefore, this species is absent from the mainstream of the Danube and the Tisza and inhabits only a few of the secondary branches (Fig. 3).

***Glossiphonia paludosa* (CARENA 1824)**

Material: Upper Tisza, Latorica near Leles, Slovakia, 1 spec., 3. Jul. 1992, leg. B. Schönbauer & W. Graf.

New to the Tisza river basin, species of zoogeographical importance. In Central and Eastern Europe, the occurence of G. paludosa is restricted only to some parts of plains and lowlands with special warmer climate. It is very common in the lower stretches of slow-flowing rivers of the Kisalföld and the Hun-



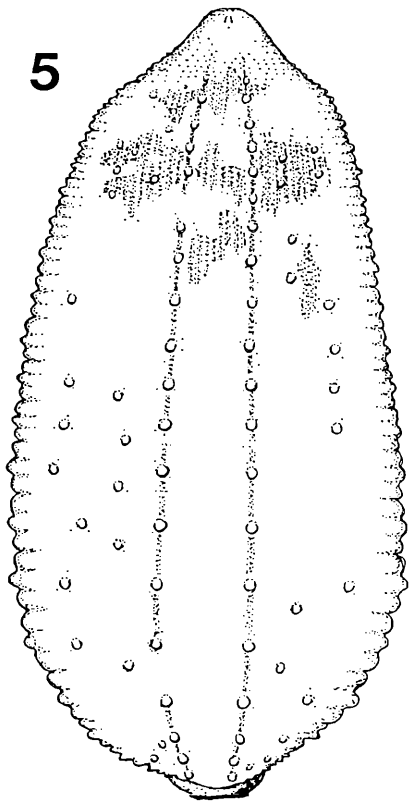


Fig. 4: *Glossiphonia nebulosa* from the Hotobágy-Berettyó near Ecsegfalva, dorsal view
Fig. 5: *Glossiphonia verrucata* from a deadwater reach of the Danube near Neuburg (Germany, Bavaria), dorsal view

garian reach of the Danube. It does not enter the upper Danube as far upstream as Vienna. In the Ráckevei Duna, *G. paludosa* is frequently found, but does not reach several similar rivers of the Tiszántúl area, e. g. the lower Hortobágy-Berettyó (Fig. 6). The absence of *G. paludosa* can not be explained by the environmental characteristics of these rivers. The reason for the asymmetrical distribution pattern of the species in the Carpathian basin might be caused by Paleogeography (MIKE 1991, BORSY 1992).

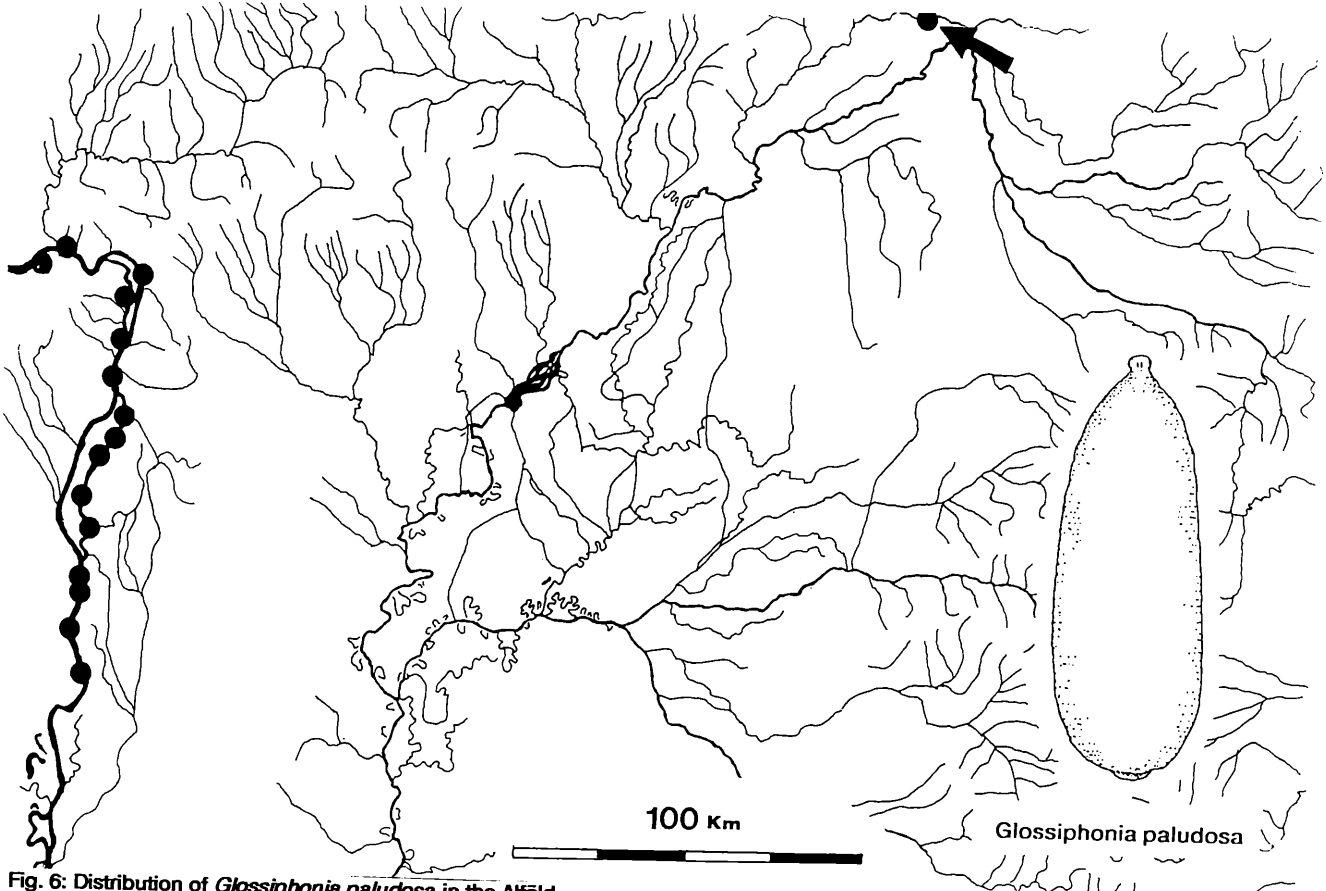


Fig. 6: Distribution of *Glossiphonia paludosa* in the Alföld

***Hemiclepsis marginata* (O. F. MÜLLER 1774)**

Material: Upper Tisza: Bátorliget, from a swampy pond, 8 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann; Latorica near Leles, Slovakia, 1 spec., 3. Jul. 1992, leg. B. Schönbauer & W. Graf.

Middle Tisza: Csíkos-fenék, Kunmadarasi puszta S Nagyiván, 7 spec., 21. Jul. 1991, leg. B. Csányi & H. Nesemann; Feketerét N Kócsújfalu, 1 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann; Papéri-csatorna NW Balmazújváros, 2 spec., 9. Jul. 1992, leg. B. Csányi & H. Nesemann; Darvasfenék SE Nagyiván, 1 spec., 22. Jul. 1991, leg. B. Csányi & H. Nesemann; Sáros-ér near Nagyiván, 3 spec. 6. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; 1 spec., 23. Jul. 1992, leg. B. Csányi & H. Nesemann; Körös, in a channel near Öcsöd, 1 spec., 22. Jun. 1992, leg. L. Forró & H. Nesemann; Hortobágy near Hortobágy, 1 spec., 6. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; Hortobágy-Berettyó near Ecsegfalva, 3 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann.

H. marginata inhabits all parts of the Danube river basin and is a common member of the fauna of European lowland rivers. It was found in secondary branches and deadwaters of the large tributaries of the upper and middle Tisza, mainly in the Hortobágyi puszta. H. marginata was collected from the zone of submerged vegetation. At first, this leech was recorded from Bátorliget (NESEMANN 1991a).

***Helobdella stagnalis* (LINNAEUS 1758)**

Material: Upper Tisza: Kraszna near Vásárosnamény, 6 spec., 14. May 1992, leg. B. Csányi; Latorica near Leles in Slovakia, 2 spec., 3. Jul. 1992, leg. B. Schönbauer & W. Graf; Szamos near Szamossályi, 10 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann; Bátorliget, from a swampy fishpond, 12 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann; Bodva near Hidvégardó, 1 spec., 19. Aug. 1992, leg. A. Vida & H. Nesemann; Sajó near Köröm, 8 spec., 13. Oct. 1992, leg. B. Csányi; Zagyva near Jásztelek, 1 spec., 5. May 1992, leg. B. Csányi; Zagyva near Pásztó, downstream, 3 spec., 5. May 1992, leg. B. Csányi.

Middle Tisza: Tisza near Poroszló, 5 spec., 9. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; 15 spec., 18. Nov. 1992, leg. L. Forró & H. Nesemann; Tisza near Sarud, 3 spec., 18. Nov. 1992, leg. H. Nesemann; Tisza, from a secondary branch near Lakitelek, 1 spec., 22. Jun. 1992, leg. S. Andrikoovics L. Forró & H. Nesemann; Csíkós-fenék, Kunmadarasi puszta S Nagyiván, 1 spec., 21. Jul. 1991, leg. B. Csányi & H. Nesemann; Feketerét N Kócsújfalu, 8 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann; Sáros-ér near Nagyiván, 3 spec., 6. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; 1 spec., 23. Jul. 1991, leg. B. Csányi & H. Nesemann; Körös, in a secondary branch near Szarvas, 1 spec., 15. Oct. 1991, leg. L. Forró & H. Nesemann; Körös at Szarvas, 2 spec., 22. Mar. 1991, leg. L. Forró & H. Nesemann; Sebes Körös near Körösladány, 9 spec., 21. Mar. 1991, leg. L. Forró & H. Nesemann; Berettyó near Darvas, 2 spec., 21. Mar. 1991, leg. L. Forró & H. Nesemann; Hortobágy near Hortobágy, 2 spec., 25. Sept. 1990, leg. L. Forró & H. Nesemann; Hortobágy NW Balmazújváros, Kis-szeg, 1 spec., 5. Jul. 1992, leg. B. Csányi & H. Nesemann; Hortobágy-Berettyó near Ecsegfalva, 10 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann.

H. stagnalis is very common throughout the whole Tisza river basin and settles various types of running and stagnant waters except of the Epirhithron stretches of mountain streams. At first it was recorded from Bátorliget (NESEMANN 1991a).

***Theromyzon tessulatum* (O. F. MÜLLER 1774)**

Material: Upper Tisza: Bátorliget, from a swampy fishpond, 4 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann.

Middle Tisza: Hortobágy near Hortobágy, 1 spec., 25. Sept. 1990, leg. L. Forró & H. Nesemann.

Parasitic leeches on ducks, found on submerged vegetation in ponds and rivers.

Alboglossiphonia heteroclita **(LINNAEUS 1761)**

Material: Upper Tisza: Kraszna near Vásárosnamény, 5 spec., 14. May 1992, leg. B. Csányi; Bátorliget, from a swampy fishpond, 7 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann.

Middle Tisza: Tisza near Poroszló, 5 spec., 9. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; 19 spec., 18. Nov. 1992, leg. L. Forró & H. Nesemann; Tisza near Sarud, 1 spec., 18. Nov. 1992, leg. H. Nesemann; Csíkos-fenék, Kunmadarasi puszta S Nagyiván, 1 spec., 21. Jul. 1991, leg. B. Csányi & H. Nesemann; Feketerét N Kócsújfalu, 11 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann; Németéri-főcsatorna near Kunmadaras, 1 spec., 24. Jul. 1991, leg. B. Csányi & H. Nesemann; Hortobágy NW Balmazújváros, Kis-szeg, 1 spec., 5. Jul. 1992, leg. B. Csányi & H. Nesemann.

This species was mainly collected in swampy stagnant waters and lowland streams, it is widespread in all Central European lowlands and lakes.

Placobdella costata **(F. MÜLLER 1846)**

Material: Bátorliget, from a swampy fishpond, 1 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann.

Middle Tisza: Orgovány, 14 spec., see SOOS (1963).

The distribution pattern of *P. costata*, rarely found in Central Europe, is of zoogeographical importance. It is not identical with that of its host, *Emys orbicularis* LINNAEUS 1758. *P. costata* settles only the Alföld including the Balaton basin, but it was never recorded from the Kisalföld. Two localities are known in the Tisza river basin. In the Kiskunság National Park, *P. costata* was collected near Orgovány at the watershed between Duna and Tisza (SOOS 1963). During our investigations, this leech was recorded for the first time in a swampy fishpond near Bátorliget. Other localities were published by SOOS (1963, marshes in the southwest of the Lake Balaton) and MIKUSKA & GEC (1970, floodplain of the Danube in Croatia). The host of the leech, *Emys orbicularis*, has a wider distribution range in the Danubian lowlands. The turtle inhabits the Danubian floodplain as far ustream as Vienna, including the lower reach of the river March (Morava).

In the upper Danubian basin *P. costata* was recorded by ZIMMERMANN (1989) from a tributary of the Mindel river in Bavaria. It might be a relict distribution or an import since the middle age, when *E. orbicularis* was a favorite Lenten fare.

Family Piscicolidae

Two genera with four species in the Tisza basin.

Piscicola geometra **(LINNAEUS 1761)**

Material: Upper Tisza, Latorica near Leles in Slovakia, 1 spec., 3. Jul. 1992, leg. B. Schönbauer & W. Graf.

Middle Tisza, Tisza (Kiskörei víztározó) near Sarud, 1 spec., 18. Nov. 1992, leg. H. Nesemann; Feketerét N Kócsújfalu, 1 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann.

P. geometra feeds on fishes, it is a temporary ectoparasit. The species is distributed in all regions of the Danube river basin, mainly found in lowland rivers and lakes. It was observed or collected for several times in rivers of the Tisza basin: BÉRETZK & al. (1957): Tisza, SZILADY (1925 in: BÉRETZK & al. 1957): Tisza near Csongrád, GÉLEI (1936, in: BERETZK & al. 1957) and SOOS (1964): Szeged, BOTOS, SZITO & OLAH (1990): Körös, on the bottom near Öcsöd.

Piscicola haranti JARRY 1960

Material: Middle Tisza, Körös, secondary branch N Szarvas, 1 spec., 16. Oct. 1991, leg. L. Forró & H. Nesemann; Feketerét N Kócsújfalu, 1 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann.

This leech species is new to the fauna of the Tisza basin. Its distribution range, not exactly known yet, might be of zoogeographical importance. *P. haranti*, described from the South of France, was recorded in Hungary for the first time from the Rábca river near Györ (NESEMANN 1991b). Since that finding, it was collected from several lowlands in Central and Eastern Europe. Now *P. haranti* is known from Northern Germany (Nordrhein-Westfalen, leg. U. Haesloop), from the upper Danube in Germany (Bavaria: Ulm, leg. B. Csányi), the middle Danube in Hungary (Szob, leg. B. Csányi) and the delta reach in Roumania (Lacul Rossu, leg. B. Csányi). Although the Austrian Danube was thoroughly investigated, *P. haranti* was not found. The distribution pattern seems to be disjuncted with isolated populations along the upper Danube (NESEMANN 1993). In the Carpathian basin, a densely inhabited area can be expected, according to the records in the west and east of Hungary.

P. haranti is easy to determine. The pigmentation differs in the arrangement of dark colouration from *P. geometra*. Using a microscope, the two species differ in their pigment cells, which are much larger and blakish colourated in *P. geometra*. The pigment cells of *P. haranti* are very small and dense, their colour is brown.

Cystobranchus respirans (TROSCHEL 1850)

Material: Middle Tisza, Boldogháza near Jászberény, ? Zagyva, Tarna or Agói-patak, 2 spec., approximately collected in 1880, leg. L. Örley, Apáthy gyüjtemény, now Collection of the Hungarian Natural Histrory Museum, Budapest.

Permanent parasite on Salmonid and Barbus. The specimens were found on the gills of salmons (ÖRLEY 1886, APATHY 1888, SOOS 1964). *C. respirans* is a common fish leech in Central and Eastern European freshwaters, but prefers mountain rivers. The species is listed for the fauna of the Danube by REICHENBACH-KLINKE (1962).

Cystobranchus fasciatus (KOLLAR 1842)

Material: Middle Tisza, Tisza at Csongrád, 1 spec., approximately collected in 1885, leg. J. Éder, Apáthy gyüjtemény, now Collection of the Hungarian Natural History Museum, Budapest.

Permanent parasite on *Silurus glanis*. This species is very rare and relatively unknown. Therefore the excact distribution range is not known. *C.fasciatus* occurs without exception in the tributaries of the Black and Caspian Sea and in some rivers of the Baltic coast in Poland. The species is in the collection of the Natural History Museum Vienna with the locality "Wien" However, the only available specimen with collecting data in a zoological museum is that from the Tisza river (SOOS 1964). The morphological features are shown on Fig. 7-9.

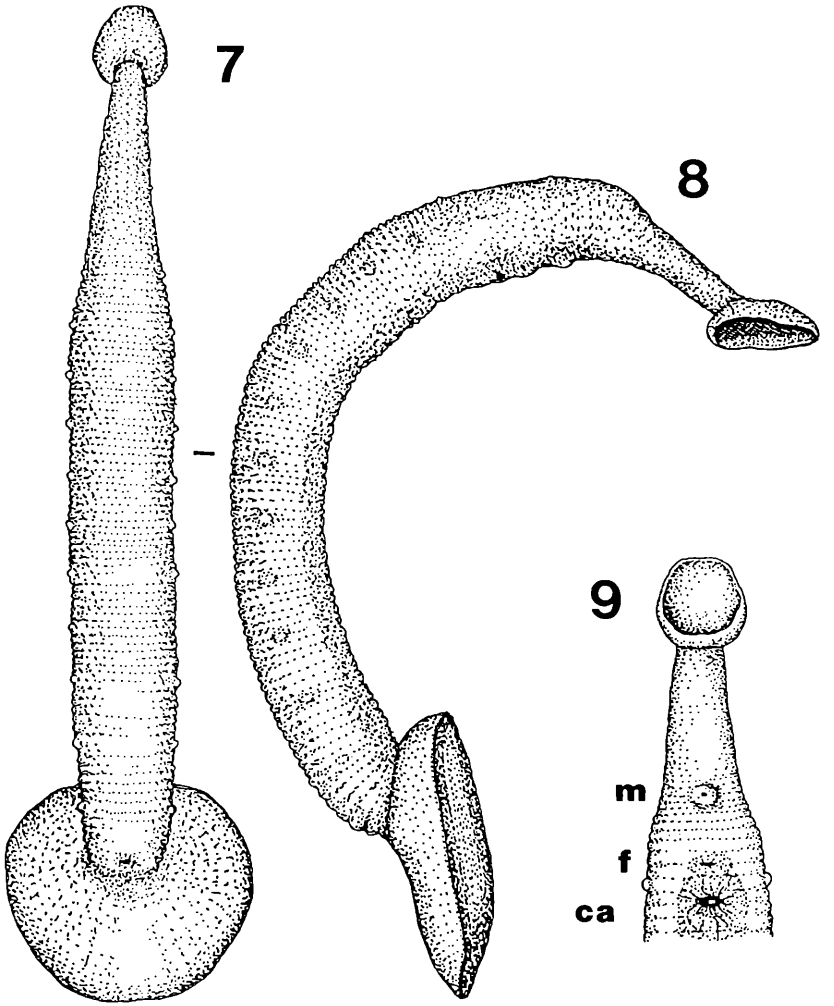


Fig. 7-9: *Cystobranchus fasciatus* from the Tisza river near Csongrád; 7: dorsal 8: lateral 9: ventral view of the anteriour part with male gonopore (m), female gonopore (f) and copulatory area (ca)

Family Hirudinidae

One genus with one species in the Tisza basin.

Hirudo medicinalis LINNAEUS 1758

Material: Upper Tisza: Bátorliget, Fényi.erdö, 1 spec., 5. May 1989, leg. F. Mészáros & E. K. Murai; Körmei-erdö, leg. L. Forró.

Middle Tisza: Hortobágy puszta: Csíkos-fenék, 3 spec., 21. Jul. 1991; Darvas-fenék, 1 spec., 22. Jul. 1991 and Feketerét, 1 spec., 25. Jul. 1991, all leg. B. Csányi & H. Nesemann; temporary pond

near the Nyugati föcsatorna E Tiszacsege, 1 spec., 6. Jun. 1991, leg. E. Rössler.

In Europe, the medicinal leech is distributed widely, probably helped by human activity during the past centuries. Nowadays, this species is very rare in Western European countries, where it is mainly restricted to its original habitat, the deadwaters of lowland rivers. In the Carpathian basin, *H. medicinalis* is still common. It was sporadically found in the floodplains of rivers in Western Hungary and Eastern Austria (MIKUSKA & GEC 1970, MILDNER & KOFLER 1988). Its center of distribution is the Alföld plain, where *H. medicinalis* occurs in a large number of Holocene riverbeds in the puszta. In the Tisza river basin, a form with three pairs of dorsal stripes (see AUTRUM 1958: 27, Fig. 40; RIETSCHEL 1971: 381, Fig. 8) is common, while along the Rhine river, the medicinal leeches have two pairs of stripes only (see RIETSCHEL 1971: 381, Fig. 7).

Limnatis nilotica (MOQUIN-TANDON 1826) seems to be completely absent from the Tisza basin, although it is known from Southern Yugoslavia (SKET 1968), Eastern Roumania and Bulgaria (SAWYER 1986). This leech has not been found in the Carpathian basin so far.

Family Haemopidae

One genus with one species in the Tisza basin.

***Haemopis sanguisuga* (LINNAEUS 1758)**

Material: Upper Tisza: Latorica near Leles in Slovakia, 1 spec., 3. Jul. 1992, leg. B. Schönbauer & W. Graf; tributary (brook) to the Kraszna river near Merk, 11 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann; Bátorliget, from a swampy fishpond, 2 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann; Pilis-Piricsel-folyás in Bátorliget, 2 spec., 7. Jun. 1991, leg. H. Nesemann; Bátorliget: Fényi-erdö and Körmei-erdö, see NESEMANN (1990).

Middle Tisza: Sáros-ér near Nagyiván, 5 spec., 6. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann; 1 spec. 23. Jul. 1991, leg. B. Csányi & H. Nesemann; Dinnyés-csatorna W Balmazújváros, 1 spec., 10. Jul. 1992, leg. B. Csányi & H. Nesemann, Papéri-csatorna NW Balmazújváros, 1 spec., 9. Jul. 1992, leg. B. Csányi & H. Nesemann.

The semiaquatic leech was found in swampy ponds, small rivers and brooks of the lowland in all investigated parts of the Tisza river basin. This species is spread all over the different types of freshwaters in Europe, including Anatolia and the Northern Levante (Israel). Until yet *H. sanguisuga* was known from several ponds and the floodplain of the Tisza river itself (ANDRASSY 1953, BÉRETZK & al. 1957, NESEMANN 1991a).

Family Erpobdellidae

Three genera with eight species in the Tisza basin.

***Erpobdella octoculata* (LINNAEUS 1758)**

Material: More than 250 specimens from 48 localities (see Fig. 10).

E. octoculata is recorded from all parts of the Tisza river basin and is the most common species of the family Erpobdellidae (Fig. 10). It lives in rivers, brooks and deadwater reaches, except of the Epirhithron, where *E. vilnensis* is dominant. The leech was recorded from several localities since the beginning of our century (BERETZK & al. 1957, BOTOS, SZITO & OLAH 1990, NESEMANN 1991a).

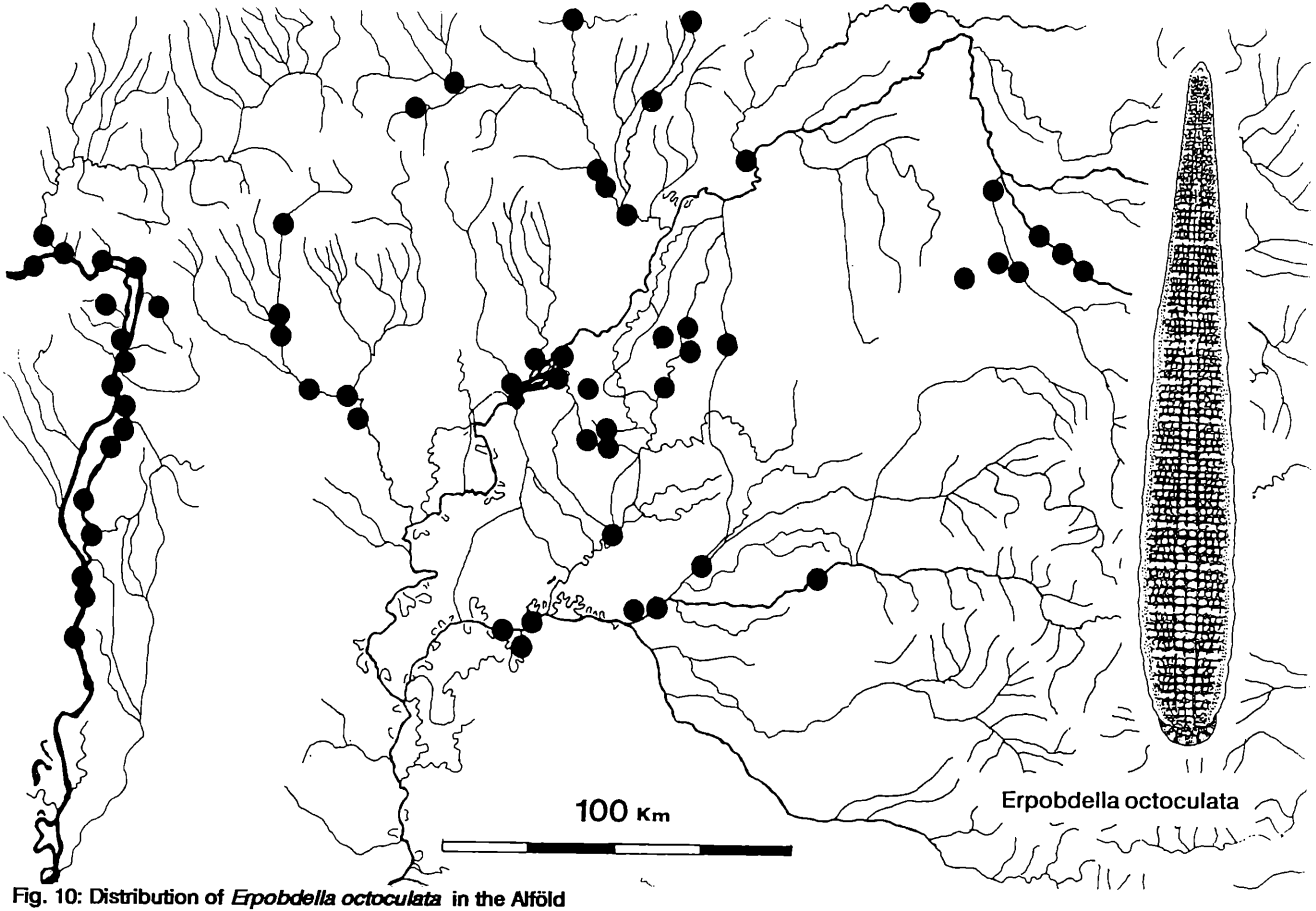


Fig. 10: Distribution of *Erpobdella octoculata* in the Alföld

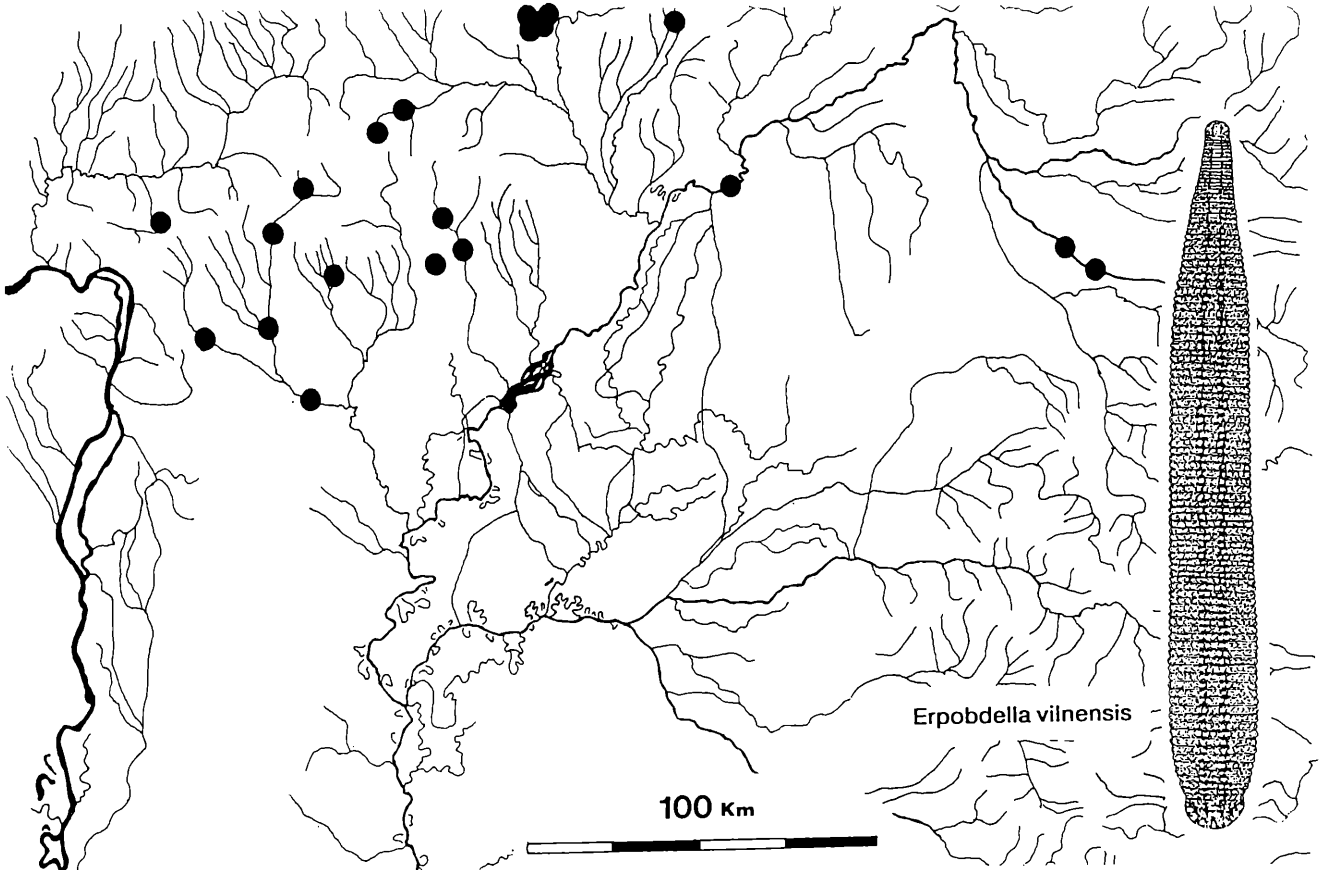


Fig. 11: Distribution of *Erpobdella vilnensis* in the Alföld

Erpobdella vilnensis LISKIEWICZ 1925

Material: Upper Tisza and mountains: Szamos near Szamossályi, 4 spec. 27. Sept. 1990, leg. L. Forró & H. Nesemann; Szamos near Csenger, 1 spec., 16. Oct. 1992, leg. B. Csányi; Hernád near Hidásnémeti, 1 spec., 6. May 1992, leg. B. Csányi; Jósva in Jósvafö, 7 spec., 18. Aug. 1992, leg. A. Vida & H. Nesemann; small left tributary to the Jósva-patak near Szinpetri, 3 spec., 19. Aug. 1992, leg. H. Nesemann; Zagyva near Nagygombos, 1 spec.; Zagyva downstream from Pásztó, 17 spec.; Zagyva near Szentlörincs káta, 1 spec.; Hangony near Domaháza, 3 spec.; Hangony downstream from Hangony, 2 spec., all 5. May 1992, leg. B. Csányi. Further records see SOOS (1963): Galgamácsa, Kétbodony, Zagyvapálfalva, Mátrafüred, Eger, Szarvaskö, Egerbakta, Szin, Szinpetri, Szalonna, upper Maros basin in Roumania.

Middle Tisza: Tisza near Tiszalök, 1 spec., 25. Mar. 1992, leg. L. Forró & H. Nesemann.

E. vilnensis occurs in running waters, mainly in brooks, streams and fast flowing rivers of the Carpathian mountains and hilly countries (SOOS 1963, 1968; KOSEL 1979, SLADECEK & KOSEL 1984). The species is absent from middle reaches of the Danube and the Tisza, from the Tiszántúl area and the central part of the Alföld plain (Fig. 11). It isstill abundant in the large tributaries of the upper Tisza and was found in the mainstream as far downstream as Tiszalök. *E. vilnensis* is the only one species of this genus, which is able to inhabit the cold and small brooks of the Aggteleki Karszt, where it occurs even in springs. A detailed description in the literature is given by SOOS (1963). Based on the collection of Hungarian Natural History Museum, he presented a number of localities from the Tisza river basin, which are considered in our distribution map.

Erpobdella nigricollis (BRANDES 1900)

Material: Upper Tisza and mountains (only in the large river valleys): Bodva near Hidvégardó, 9 spec., 19. Aug. 1992, leg. A. Vida & H. Nesemann; Sajó near Banréve, 9 spec., 20. Aug. 1992, leg. A. Vida & H. Nesemann; Sajó near Sajókaza, 1 spec., 5. May 1992, leg. B. Csányi; Hernád near Hidasnémeti, 3 spec., 6. May 1992, leg. B. Csányi.

Middle Tisza: Tisza near Tiszafüred, 5 spec., 10. Aug. 1990, leg. M. Hauser; Keleti-föcsatorna near Balmazújváros, 3 spec., 24. Jun. 1992, leg. L. Forró & H. Nesemann; Hortobágy: Feketerét N Kocsújfalu, 6 spec., 25. Jul. 1991, leg. B. Csányi & H. Nesemann; Dinnyés-csatorna NW Balmazújváros, 5 spec., 10. Jul. 1992, leg. B. Csányi & H. Nesemann; Papéri-csatorna NW Balmazújváros, 8 spec., 9. Jul. 1992, leg. B. Csányi & H. Nesemann; Berettyó near Darvas, 1 spec., 21. Mar. 1991, leg. L. Forró & H. Nesemann; Hortobágy-Berettyó near Ecsegfalva, 12 spec.; Hortobágy-Berettyó near Túrkeve, 5 spec., all 24. Mar. 1992, leg. L. Forró & H. Nesemann.

New to the Tisza river basin, species of zoogeographical importance. *E. nigricollis* is a characteristic member of Potamon biocoenoses of Central and Eastern European lowland rivers. It is distributed throughout the whole Carpathian basin (Fig. 12) but does not enter the Danube as far as the Szigetköz reach. Relict populations are known from the Bavarian section of this river. In the Alföld plain, *E nigricollis* was found in all larger rivers. The distribution in the Sajó, Hernád and Bódva rivers is extended upstream towards Slowakia, like the distribution range of the bivalve *Unio tumidus zelebori* ZELEBOR 1851. This might be caused by the environmental characteristics of these waters, which are similar to lowland rivers.

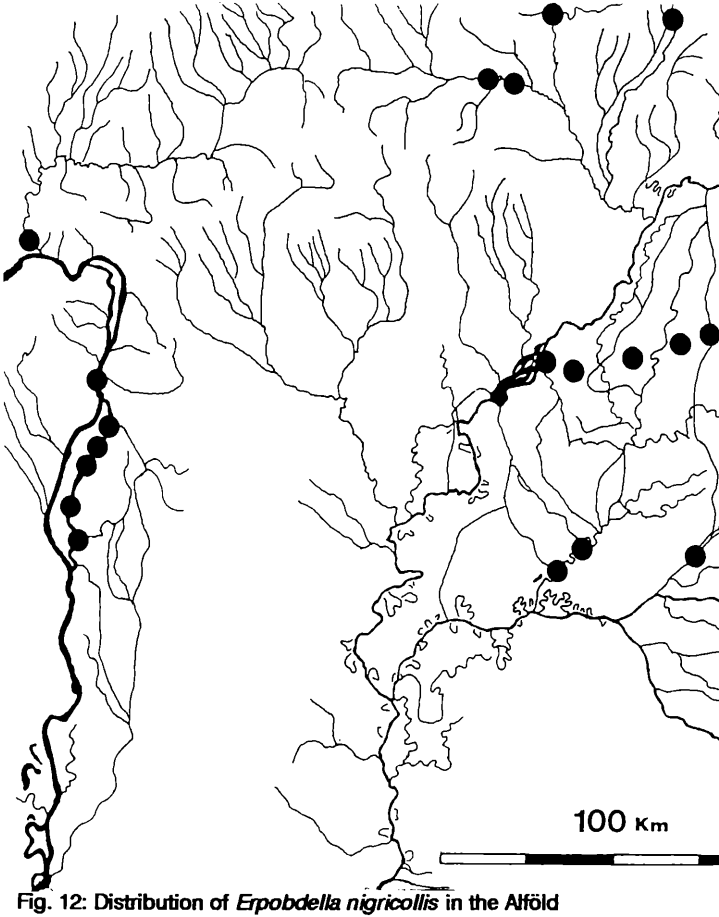


Fig. 12: Distribution of *Erpobdella nigricollis* in the Alföld

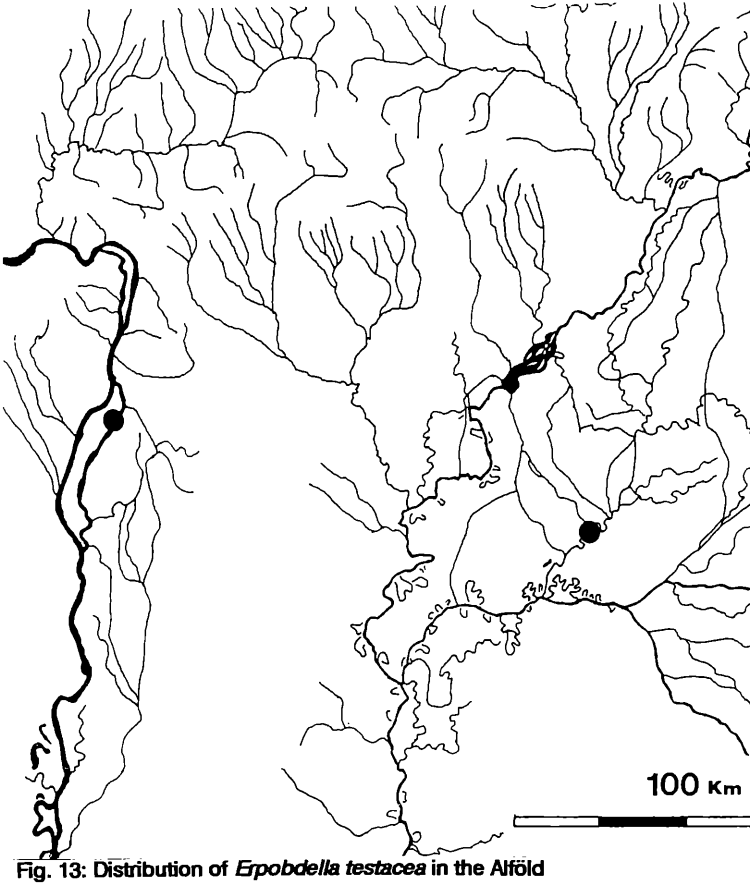


Fig. 13: Distribution of *Erpobdella testacea* in the Alföld

***Erpobdella testacea* (SAVIGNY 1822)**

Material: Upper Tisza: Latorica near Leles in Slovakia, 1 spec., 3. Jul. 1992, leg. B. Schönbauer & W. Graf; Bátorliget, from a swampy fishpond, 8 spec., 27. Sept. 1990, leg. L. Forró & H. Nesemann.

Middle Tisza: Hortobágy-Berettyó near Ecsegfalva, 7 spec., 24. Mar. 1992, leg. L. Forró & H. Nesemann.

Species of zoogeographical importance, known from Bátorliget (NESEMANN 1991a). Its distribution range includes all parts of the Alföld and Kisalföld plains (Fig. 13). *E. testacea* is restricted to swampy rivers and streams of the lowlands, it is not known for the upper Danube in Austria and Germany so far.

***Dina lineata* (O. F. MÜLLER 1774)**

Material: Channel of the Köros river NE Gyomaendröd, 1 spec., 22. Mar. 1992; Tisza near Poroszló, 1 spec., 18. Nov. 1992, both leg. L. Forró & H. Nesemann.

New to the Tisza river basin, species of zoogeographical importance (Fig. 14). *D. lineata* inhabits swampy ponds and slowly running rivers and sreams. It does not enter the upper Danube but is distributed throughout the whole Carpathian basin (SOOS 1967; KOSEL 1983; NESEMANN 1991c).

***Dina apathyi* GEDROYC 1916**

Material: Zagyva near Jászberény, 1 spec., 9. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann.

New to the Tisza river basin, species of zoogeographical importance. *D. apathyi* is known only from the western part of the Carpathianbasin. It is abundant in the Ráckevei Duna, but surprisingly absent from similiar rivers in the Tiszántúl region (Fig. 14). This fact can not be understood by the ecological preferences, however it might be caused by the paleogeographical genesis (Fig. 15).

***Trocheta cylindrica* ÖRLEY 1886**

Material: Upper Tisza: Kraszna near Mérk, 1 spec., 15. Oct. 1992, leg. B. Csányi; further records see SOOS (1958), partim, e.g. Tisza near Tarpa.

Middle Tisza: Hortobágy near Hortobágy, 1 spec., 25. Sept. 1990, leg. L. Forró & H. Nesemann; Körös downstream from Szarvas, 3 spec., 22. Mar. 1991, leg. L. Forró & H. Nesemann; Sáros-ér near Nagyiván, 1 spec., 6. Jun. 1991, leg. E. Rössler, L. Forró & H. Nesemann.

Species of zoogeographical importance. *T. cylindrica* was described by ÖRLEY (1886) from the Beszterce river, now Bistriza in Roumania. It inhabits rivers and streams, mainly in the lowlands (Fig. 16). Semiaquatic life on muddy banks, distribution strongly restricted to the tributaries of the Black Sea, absent from the upper Danube. The majority of the localities, listed by SOOS (1958) under the name *T. bykowskii* GEDROYC 1916, belong to this species.

***Trocheta bykowskii* GEDROYC 1912**

Material: Bódva near Hidvégardó, 2 spec., 19. Aug. 1992, leg. A. Vida & H. Nesemann, further records see SOOS (1958), partim.

Species of zoogeographical importance. This leech lives in the interstitial bottom zone, which is influenced by the mixing of groundwater with the river. It occours in Central European mountains and prefers springs, brooks and rivers with gravely or stony substrate. Its distribuition range includes the whole

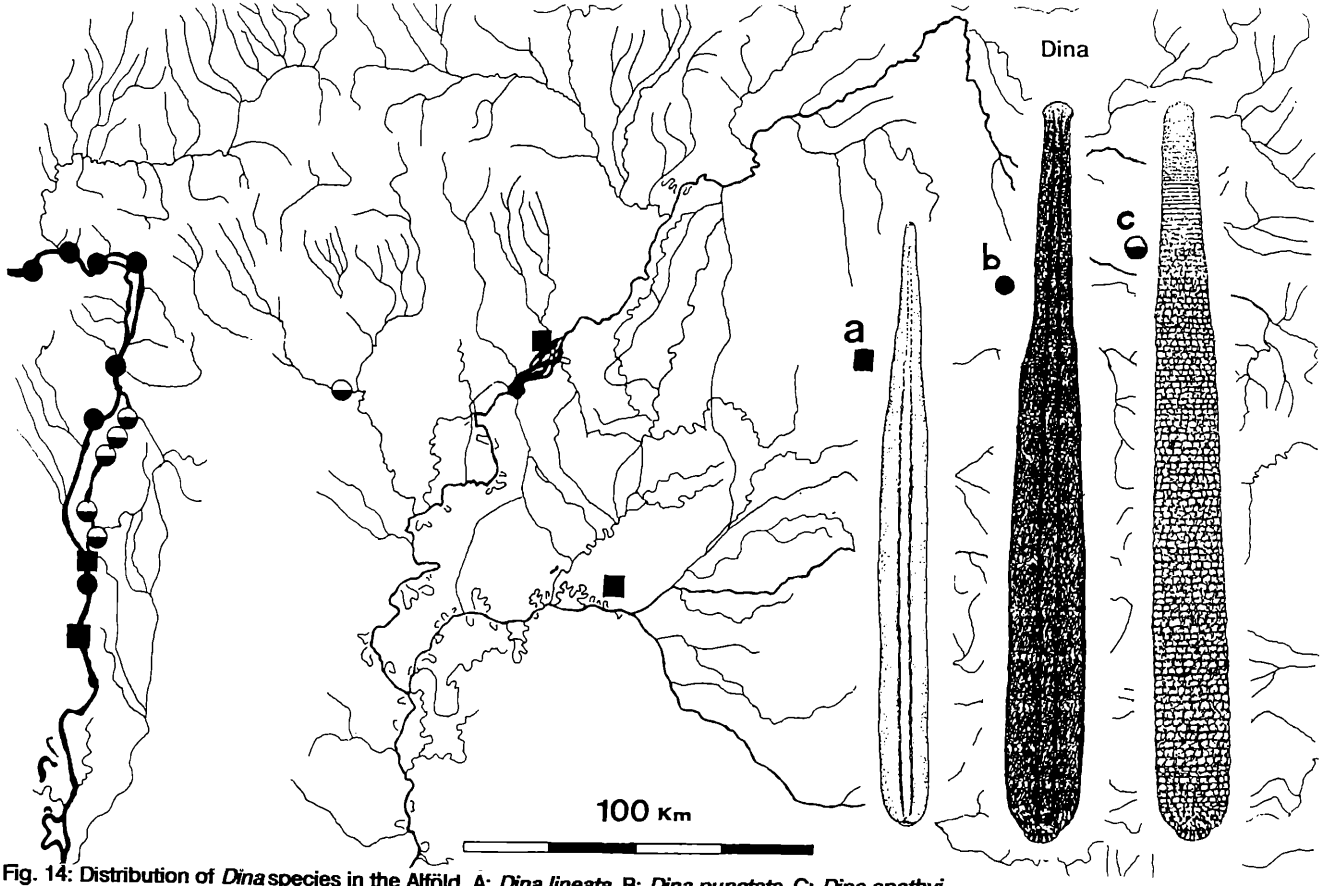


Fig. 14: Distribution of *Dina* species in the Alföld. A: *Dina lineata*, B: *Dina punctata*, C: *Dina apathyi*

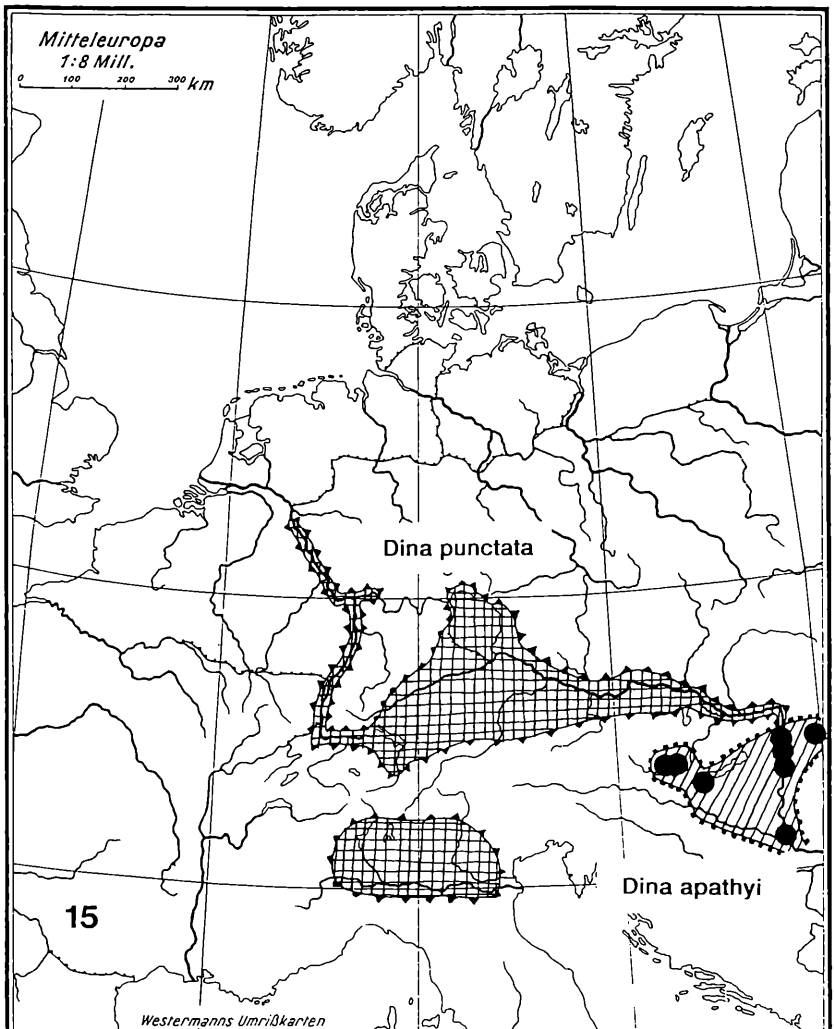


Fig. 15: Distribution of *Dina punctata* and *Dina apathyi* in Central Europe

Carpathians (SOOS 1958 partim, KOSEL 1980 partim), but it is mainly frequent in higher regions between 400 and 1000 meters above sea level. Its appearence in the Bódva river, as far downstream as the Epipotamon reach might be caused by the addition of groundwaters into the river bed or by drifting downfrom the upper reach, where a typical Rhithron fauna with *Cottus poecilopus* HECKEL 1836, lives (VIDA pers. comm.). *T. bykowskii* was recorded by SOOS (1958) for the uppermost tributaries of the Tisza and Maros rivers in the Roumanian and Ukrainian Carpathians.

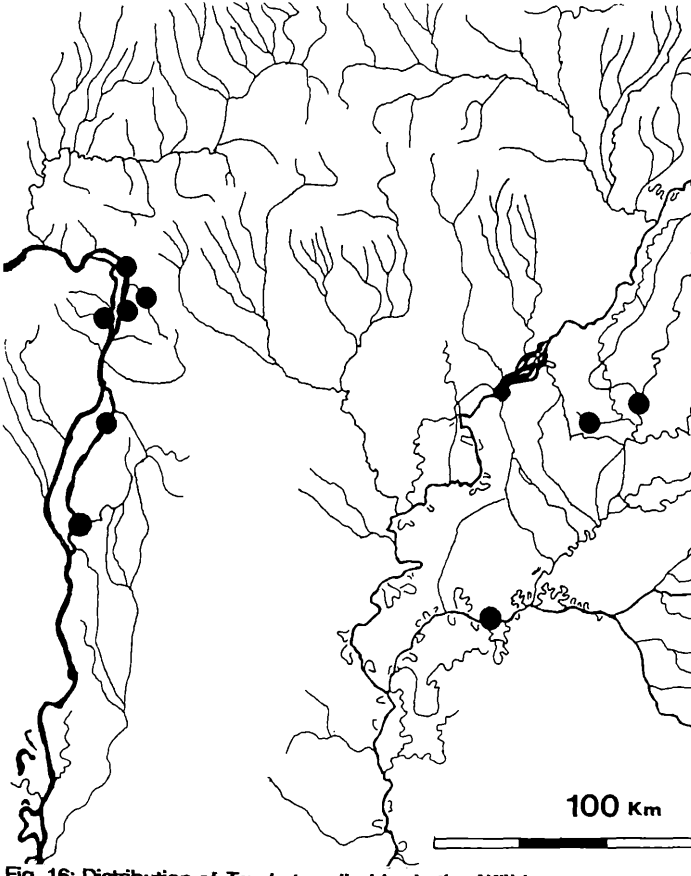
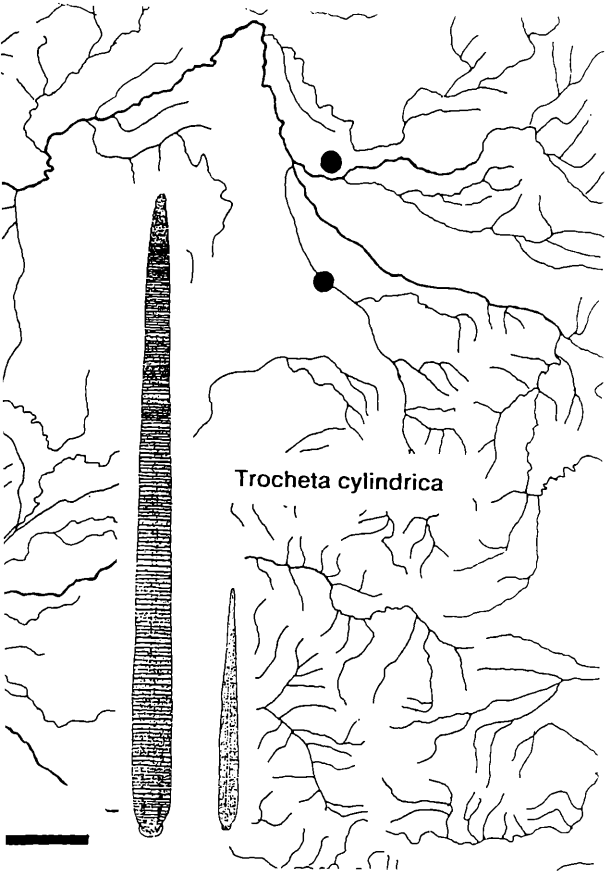


Fig. 16: Distribution of *Trocheta cylindrica* in the Alföld



4 Distribution patterns of freshwater animals in the Carpathian basin.

The majority of leech species is spread widely throughout the whole Carpathian basin. *Erpobdella vilnensis* occurs in all Rhithron stretches of mountain streams from the Eastern Alpes in Austria to the Central Carpathians in Roumania. *Erpobdella nigricollis* is abundantly recorded from Potamon of the larger lowland rivers. Its distribution range includes the Eastern Vienna plain in Austria (March, Thaya), the Kisalföld and the whole Alföld with the Danube, Tisza and their left and right tributaries. Similar distribution patterns were found for *Trocheta cylindrica, Dina lineata, Glossiphonia concolor* and other leeches. All of them belong to a large group of freshwater organisms of Pontocaspian origin, which inhabit the whole basin of the middle Danube, e. g. the molluscs *Viviparus acerosus* (BOURGUIGNAT 1853), *Unio tumidus zelebori* and *Sphaerium nucleus* (STUDER 1820; see KORNIUSHIN 1992). Therefore they can not be used to explain the special zoogeographical situation of the Tisza basin.

However, five other groups of freshwater organisms are very important for zoogeographical analysis and they are to be shown here (Tab. 1-3):

1.Endemic freshwater animals of the Eastern Carpathian basin (Tisza river basin)

The fauna of the Tisza basin is not only a Danubian fauna as some authors suppose. The occurence of a number of endemic species and subspecies results from the isolation during the Miocene and Pliocene period (Original "Tisza" fauna), when the former river flowed into the Pannonian Sea. Endemicsare known for fishes, lampreys, unionid mussels and prosobranchiate snails but not for leeches (Tab. 1-2). The most prominents are *Eudontomyzon danfordi* (Cyclostomata) and *Melanopsis parreyssi* (Gastropoda). The last one settles only the warm spring in Püspök-fürdö (Oradea in Roumania). Here the fauna differs completly from all other warm springs of the Carpathian basin (BRUSINA 1902).

2. Freshwater animals with a wide distribition range, which do not settle the Tisza river basin

Surprisingly, a number of snails and leeches, dominant in the Alföld reach of the Danube, are absent from the Tisza fauna, e. g. *Esperiana esperi, Theodoxus danubialis* (Gastropoda) and *Dina punctata* (original "Danubian" fauna). Others are strongly restricted to the western part of the Hungarian lowlands, like *Batracobdella algira* and *Holandriana holandrii* (Gastropoda) (Tab. 2).

3. Freshwater animals, which are mainly restricted on the Eastern Carpathian Basin (Alföld including Balaton basin)

Several animals with a wide distribution range in the Tisza basin are mainly restricted on this river system (Tab. 3). Their range is bordered with some rivers in the Alföld , which were former tributaries of the Tisza or the Pliocene Slavonian lake. A well known example is the asymmetrical distribution pattern of *Barbus meridionalis petenyi* (Pisces - Original fauna of the Pliocene "Tisza"). Similar are *Placobdella costata* and a few Amphipods. *Branchiura sowerbyi* (Tab. 3) is one of the dominant Oligochaets of the Tisza, while it was never found in

the upper Danube. Isolated records are recently found in thermal springs near Vienna.

4. Endemic freshwater animals of the Western Carpathian basin (basin of the middle Danube including the Vienna plain)

Trocheta riparia in the upper Rába and (?) Dráva basin. *Belgrandiella* (Gastropoda), The endemic species in the warm springs of Bad Vöslau and Bad Fischau, Vienna plain in Austria (Tab. 2). *Unio crassus minor* in the Kisalföld rivers (Tab. 1). Together with endemic freshwater animals of the upper Danube, they are present at some areas of the Westernern Carpathian basin (e. g. *Dina punctata*, *Unio crassus cytherea* (KÜSTER 1833), but never reached the Tisza.

DUNA	TISZA
Unio pictorum latirostris KÜSTER 1833	*Unio pictorum tisianus* NESEMANN, in prep.
Unio crassus minor ROSSMÄSSLER 1835	*Unio crassus ondovensis* HAZAY 1885
Bythinella austriaca (FRAUENFELD 1857)	*Bythinella pannonica* (FRAUENFELD 1865)
Cobitis aurata PHILLIPI	*Cobitis aurata bulgarica* DRENSKY 1928
	Cobitis romanica BACESCU 1943
Eudontomyzon mariae BERG 1831	*Eudontomyzon danfordi* OLIVA & ZANANDREA 1959
	Eudontomyzon gracilis KUX 1965

Tab 1: The main differences of the freshwater fauna between the western part (Duna) and eastern part (Tisza) of the Carpathian basin. Allopatric and endemic taxa

DUNA	TISZA
Theodoxus danubialis (C. PFEIFFER 1828)	
Belgrandiella parreyssi (L. PFEIFFER 1841)	
Esperiana esperi (A. FÉRUSSAC 1823)	
Holandria holandrii (C. PFEIFFER 1823)	
Stagnicola turricola (HELD 1836)	
Dina punctata JOHANSSON 1927	
Trocheta riparia NESEMANN 1993	
Batracobdella algira (MOQUIN-TANDON 1846)	
	Cordylophora caspia (PALLAS 1771)
	Theodoxus "prevostianus" ssp. (Püspök-fürdö)
	Bythinella molcsany J. WAGNER 1941
	Melanopsis parreyssi PHILIPPI 1847
	Scardinus erythrophthalmus racovitzai G. MÜLLER 1958

Tab 2: The main differences of the freshwater fauna between the western part (Duna) and eastern part (Tisza) of the Carpathian basin. Taxa with restricted distribution area, including endemic forms

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5. Freshwater animals with a wide distribution range in the Westernern Carpathian basin, which are present only in some northwestern tributaries of the Tisza.

From the zoogeographical point of view, this is the most interesting group of species, which should be thoroughly investigated in the future (Tab. 3). Their disjunct distribution range is actually not understandable. The most striking examples are *Glossiphonia paludosa, Dina apathyi* and *Microcolpia acicularis* (Gastropoda), which occur frequently in the Danube. They are absent from very similar habitats in the Tisza basin. Summarizing the available literature, we can expect additional freshwater animals, that are strongly restricted to northwestern tributaries of the Tisza. On the basis of the Pleistocene river connections, they might be considered as Pleistocene "Danubian immigrants". This hypothesis raises further unanswered questions. Except of a few warm springs in the northwest, *Microcolpia acicularis* and *Theodoxus prevostianus* are not present in the Tisza fauna (the taxonomical value of subfossil *Theodoxus* species from Püspök-fürdö is not understandable yet. Further investigations on the *Theodoxus danubialis group* are necessary).

Perhaps the thermal fauna of these habitats (between Eger and Miskolc) originated from the Danube basin was using the same way of invasion as described below. If there was a real Pleistocene faunal exchange, all species of this group are not belonging to the original Tisza fauna.

5 Differences between the fauna of the Danube and the Tisza

Although the Tisza nowadays is a tributary of the Danube, the fauna differs markedly. This was caused by the isolation of the freshwaters duringthe period of the Neogene Parathethys and Pannonian Sea. During the Pleistocene period, the two large rivers were connected, when the Danube brook through the Dunakanyar and started filling up the Alföld with sediments (MIKE 1991, BORSY 1992). During the last glacial epoch, the river connection was interrupted and the Danube shifted its mainstream to its present bed (BORSY 1992). Now, the faunal pathway exists along the lower Tisza. Surprisingly, many species do not invade the Tisza. The reason is not completely understandable. Probably the long course and the absence of gravel and stony substrate is of great importance by fixing the main faunal borders.

In general, the Tisza can be characterized by several endemic freshwater animals (Tab. 1-2), but endemic leeches have not been recorded so far. Compared with the Danube, the faunal diversity in the lowland rivers decreases because of the absence of some species or even genera. The main features can be demonstrated using the leech fauna. A number of typical Danubian leeches does not occur in the floodplain of the Tisza. While leeches are abundant in the middle Danube, they are nearly absent from the bottom of the middle Tis-

DUNA	TISZA
Theodoxus prevostianus (C. PFEIFFER 1828)	Northwestern tributaries, Thermal springs between Eger and Miskolc
Microcolpia acicularis (A. FÉRUSSAC 1823)	Northwestern tributaries, Thermal springs between Eger and Miskolc
Dina apathyi GEDROYC 1916	Northwestern tributaries, Zagyva
Glossiphonia paludosa (CARENA 1824)	Northwestern tributaries, Latorica
Niphargus hrabei S. KARAMAN 1932	Northwestern tributaries, Zagyva
Thermal springs in the Vienna plain (? relicts), Alföld Duna	*Branchiura sowerbyi* BEDDART 1892
Alföld Duna	*Theodoxus fluviatilis euxinus* (CLESSIN 1885)
Alföld including Balaton basin	*Niphargus valachicus* DOBREANU & MANOLACHE 1833
Alföld including Balaton basin	*Orchestia cavimana* HELLER 1865
Alföld including Balaton basin	*Placobdella costata* (FR. MÜLLER 1846)
Alföld including Ipoly, Dráva and Mura	*Barbus meridionalis petenyi* HECKEL 1847

Tab 3: The main differences of the freshwater fauna between the western part (Duna) and eastern part (Tisza) of the Carpathian basin. Taxa indicating a probable faunal exchange during Pleistocene caused by river capture (MIKE 1991, BORSY 1992)

za. Therefore Triclads (*Dugesia*-species) take place instead of leeches. Similar observation (JATZEK 1985) is known for the lower Rhine (Waal, The Netherlands), where the leeches disappeared after the invasion of *Dugesia tigrina*.

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References

ANDRASSY, I. (1953): Bátorliget vízben élö faunája.- in: SZÉKESSY, V. (ed.): Bátorliget élövilága. Akadémiai Kiadó: 143-145, Budapest.

APATHY, I. (1888): Süßwasser-Hirudineen. Ein systematischer Essay. - Zool. Jahrb. Syst. **3**: 725-794, Jena.

AUTRUM, H. (1958): Hirudinea, Egel.- in: BROHMER, P., P. EHRMANN & G. ULMER (ed.): Die Tierwelt Mitteleuropas. **1,7b**: 1-30; Leipzig.

BÉRETZK, P., G. CSONGOR, A. HORVATH, A. KARPATI, G. KOLOSVARY, M. SZABADOS & M. SZÉKELY (1957): Das Leben der Tisza. 1. Über die Tierwelt der Tisza und ihrer Inundationsgebiete.- Tiscia: 81-108, Szeged Ort.

BORSY, Z. (1992): Die Entwicklungsgeschichte des Donau-Theiß-Zwischenstromlandes.- in: BILLWITZ, K., K.-D. JÄGER & W. JANKE (ed.): Jungquartäre Landschaftsräume. Aktuelle Forschungen zwischen Atlantik und Tienschan: 236-242, (Springer) Berlin etc.

BOTOS, M., A. SZITO & J. OLAH (1990): Macrozoobenthos communities in Hungarian lowland rivers.- Aquacultura Hungarica (Szarvas) **6**: 133-152, Szarvas.

BRUSINA, S. (1902): Eine subtropische Oasis in Ungarn.- Mitt. Nat. Ver. Steiermark 1902: 101-121, Graz.

JATZEK, H.-J. (1985): Das Makrozoobenthon des schiffbaren Rheins. Vergleich der Jahre 1980 und 1982.- Mainzer naturwiss. Arch. Beiheft **5**: 67-83, Mainz.

KARAMAN, S. (1970): Beitrag zur Kenntnis der europäischen Branchiobdelliden (Clitellata, Branchiobdelloidea).- Int. Rev. ges. Hydrobiol. **55**: 325-333, Berlin.

KORNIUSHIN, A. (1992): Anatomical aspects of the taxonomy and phylogeny of Pisidioidea (Bivalvia).- Proc. 10. Int. Malacol. Congr. (Tübingen 1989): 601-605, Tübingen.

KOSEL, V. (1979): Nase nezname pijavice: Erpobdella monostriata.- Ziva **27(3)**: 102, Bratislava.

KOSEL, V. (1980): Nase nezname pijavice II: Trocheta bykowskii.- Ziva **28(4)**: 141, Bratislava.

KOSEL, V. (1981): Nase nezname pijavice III: Glossiphonia concolor.- Ziva **29(5)**: 184, Bratislava.

KOSEL, V. (1982a): Ecology of leeches (Hirudinea) in the Hornád, Hnilec and Torysa river basin with the respect to human activity.- 200 pp., Diss. Univ. Bratislava.

KOSEL, V. (1982b): Leeches of the polluted strech of the Hornád River and after improvementof the water quality.- Conference Zivocisstvo ako indikator zmien zivotneho prostredia, Zool. Inst. Comenius University, Bratislava, 19.

KOSEL, V. (1983): Nase nezname pijavice IV: Dina apathyi.- Ziva**31(3)**: 101, Bratislava.

MIKE, K. (1991): Magyarország ösvizrajza és felszíni vizeinek története.- 698 pp., Budapest.

MIKUSKA, J. & D. GEC (1970): Prilog proucavanju Faune Pijavcica (Hirudinea) plavnog prodrucja Rijeke Dunava u Baranji.- Ekologija **5**: 225-233, Belgrad.

MILDNER, P. & A. KOFLER (1988): Zur Verbreitung von Egeln (Annelida: Hirudinea) in Kärnten und Osttirol. - Carinthia II. **178**: 515-521, Klagenfurt.

NESEMANN, H. (1990): Investigations on two Glossiphonia species (Hirudinea) from running waters of Central Europe with a redescription of Glossiphonia concolor (APATHY, 1888). Annls hist.-nat. Mus. natn. hung. **82**: 65-74, Budapest.

NESEMANN, H. (1991a): The Hirudinea fauna of Bátorliget and its environs.- in: MAHUNKA, S. (ed.): The Bátorliget Nature Reserves - after forty years. Hungarian Natural History Museum: 227-236, Budapest.
NESEMANN, H. (1991b): Erstnachweis des Fischegels Piscicola haranti JARRY, 1960 (Hirudinea, Piscicolidae) im Donautiefland in Ungarn.- Fischökologie Aktuell **4**: 14-16, Petersberg.
NESEMANN, H. (1991c): Zoogeography and composition of leech fauna of Danubian lowland rivers in the Kisalföld compared with some molluscs (Hirudinea, Gastropoda).- Miscnea zool. hung. **6**: 35-51, Budapest.
NESEMANN, H. (1992): Species composition and zoogeography of the invertebrate fauna at the lower reaches of the Lajta River.- Miscnea zool. hung. **7**: 15-38, Budapest.
NESEMANN, H. (1993): Beschreibung wenig bekannter Egel aus dem pannonischen Tiefland in Ungarn und Österreich.- Limnologie Aktuell 2 (Biologie der Donau), Stuttgart (im Druck).
ÖRLEY, L. (1886): A magyarországi piócák faunája.- Math. Term.-tud. Közl. **22**: 63-115, Budapest.
POP, V. (1965): Systematische Revision der europäischen Branchiobdelliden (Oligochaeta).- Zool. Jahrbücher (Abt. Syst. Ökol. Geogr.) **92**: 219-238, Jena.
REICHENBACH-KLINKE, H.-H.(1962): Die Parasiten der Donaufische.- Arch. Hydrobiol. Suppl. **27** (Donauforschung 1): 40-56, Stuttgart.
RIETSCHEL, P. (1971): Die Gliederwürmer.- In: EIBL-EIBESFELDT, I. & al. (ed.): Grzimeks Tierleben. Enzyklopädie des Tierreichs. Band 1. Niedere Tiere: 361-386, (Kindler) Zürich.
SAWYER, R. T. (1986): Leech Biology and Behaviour, Vol. 1-3, pp. 1-1065, Oxford Science Publications.
SKET, B. (1968): Zur Kenntnis der Egel-Fauna (Hirudinea) Jugoslawiens. - Acad. Sci. Art. Slovenica CL. IV Pars Historiconaturales, Diss. 9(4): 127-178.
SLADECEK, V. & V. KOSEL (1984): Indicator Value of Freshwater Leeches (Hirudinea) with a Key to the Determination of European Species.- Acta hydrochim. et hydrobiol. **12**: 451-461, Berlin.
SOOS, A. (1958): New data to the ecology and distribution in the Carpathian basin of Trocheta bykowskii Gedr. (Hirudinea).- Annls hist.-nat. Mus. natn. hung. **55**: 285-292, Budapest.
SOOS, A. (1963): New leeches (Hirudinea) from the fauna of Hungary.- Annls. hist.-nat. Mus. natn. hung. **55**: 285-292 Budapest.
SOOS, A. (1964): A revision of the Hungarian fauna of Rhynchobdellid leeches (Hirudinea).- Opusc. zool. **5(1)**: 107-112, Budapest.
SOOS, A. (1968): Identification key to the species of the genus Erpobdella de Blainville, 1818 (Hirudinoidea: Erpobdellidae).- Annls. hist.-nat. Mus. natn. hung. **60**: 141-145, Budapest.
SUBCHEV, M. (1984): On Hungarian Branchiobdellids (Olgiochaeta: Branchiobdellidae).- Miscellanea zool. hung. **2** : 47-50, Budapest.
WEINZIERL, A. (1989): Boreobdella verrucata (FR. MÜLLER) in der niederbayerischen Donau (Hirudinea: Glossiphonidae).- Lauterbornia **1**: 60, Dinkelscherben.
ZIMMERMANN, D. (1989): Haementeria costata (FR. MÜLLER) (Hirudinea) in einem Zufluß der Mindel/Donau.- Lauterbornia **2**: 54, Dinkelscherben.

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